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(54) **DRILL BIT**

(57) A drill bit (1) comprises a body (2) of the drill bit (1) and at a distance from a face of the drill bit (1), reamer blade wings (21) moving outwards from a side (6) of the body (2) of the drill bit (1). When the drill bit (1) is rotated in the intended drilling direction, the reamer blade wings (21) are adapted to move outwards from the side (6) of the body (2) of the drill bit (1), extending outside the largest outer diameter of the body (2) of the drill bit (1) to enlarge the hole being drilled. When the drill bit (1) is rotated in the opposite direction, the reamer blade wings (21) are adapted to return inside the largest outer diameter of the body (2) of the drill bit (1) for pulling the drill bit (1) out of the hole being drilled.

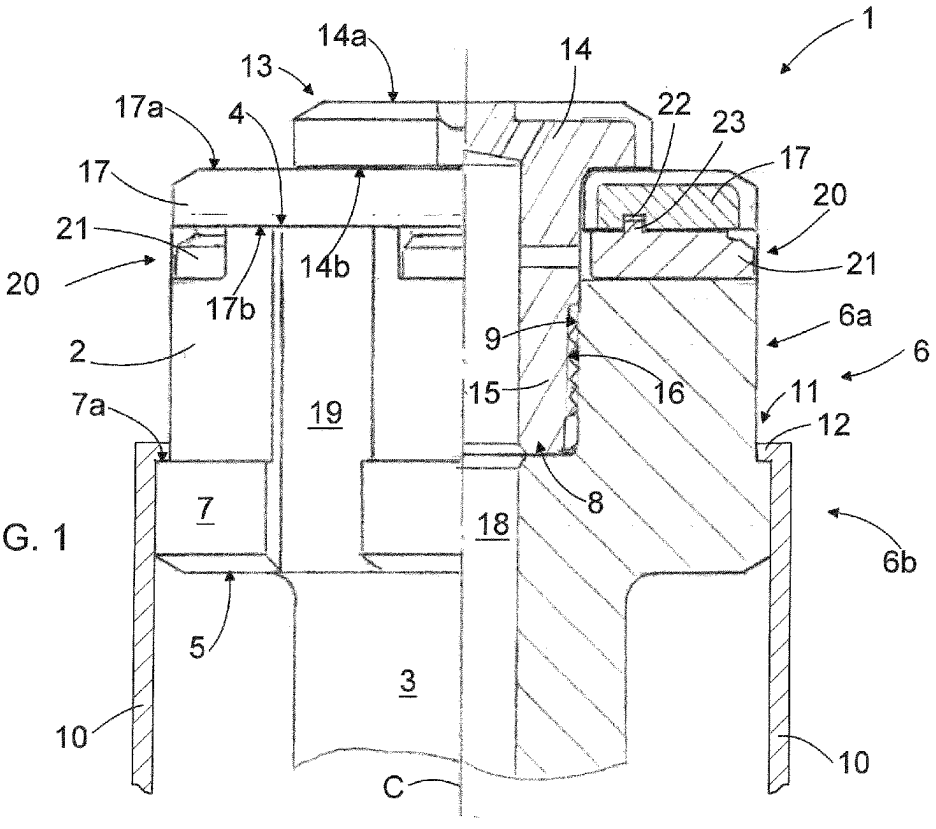

FIG. 1

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Description

Background of the invention

[0001] The invention relates to a drill bit meant for drilling into the ground or rock.

[0002] WO publication 2015/059341 A1 discloses a drilling device which comprises a pilot bit drilling a middle portion of a hole and, detachably connectable to it, a ring bit which drills the outer circle of the hole, as well as an arrangement for pulling a protective pipe into said hole during drilling,

[0003] A problem with a drilling device of the kind referred to in the above example is that as the drilling device is pulled out of said drilled hole so that the protective pipe is left in place in the drilled hole, it is also necessary to leave in place the ring bit drilling the outer circle of the hole at the bottom of the drilled hole at the end of the protective pipe.

Brief description of the invention

[0004] It is an object of the invention to provide a new type of drill bit.

[0005] The drill bit according to the invention is characterized by what is disclosed in the independent claim.

[0006] The invention is based on the drill bit comprising reamer blade wings moving outward from a side of a body of the drill bit, which are arranged, when the drill bit is rotated in the intended drilling direction, to move outwards from the side of the body of the drill bit, extending past the largest outer diameter of the drill bit to enlarge the hole being drilled, and as the drill bit is rotated in the opposite direction, to return back inside the largest outer diameter of the drill bit in order to pull out the drill bit from the hole being drilled.

[0007] The reamer blade wings moving outwards and back inwards from the side of the body of the drill bit and extending, at least in their outmost position, outside the largest outer diameter of the drill bit, enlarge the hole being drilled as the drill bit is being rotated in the intended drilling direction and in such a situation being outwards from the side of the body of the drill bit, so that the protective pipe to be placed in the hole being drilled fits in the drilled hole. When the drill bit is rotated in the opposite direction, the reamer blade wings are arranged to move back inwards whereby the outer diameter of the drill bit returns to substantially its original dimension whereby the drill bit in its entirety has room to be pulled out of the drilled hole through the protective pipe. In such a case, none of the drill bit parts need to be left in drilled hole.

[0008] Some embodiments of the invention are presented in the dependent claims.

Brief description of the drawings

[0009] Some embodiments of the invention are described in greater detail in the accompanying drawings, in which

Figure 1 schematically shows a side view of a drill bit partly in cross-section,

Figure 2 is a schematic top view of the drill bit of Figure 1, open at the reamer blade wings of the drill bit,

Figure 3 schematically shows a side view of the drill bit of Figure 1, partly in cross-section, during use of the drill bit as the drill bit is rotated in the drilling direction, and

Figure 4 is a schematic top view of the drill bit of Figure 1, open at the reamer blade wings of the drill bit, in a drill bit usage situation of Figure 3.

[0010] For reasons of clarity, some embodiments of the invention are illustrated in the Figures in a simplified form. In the figures, like reference numerals identify like elements.

Detailed description of the invention

[0011] Figure 1 schematically shows a side view of a drill bit 1, partly in cross-section, intended for drilling into the ground or rock. Figure 1 further shows, in cross section, a protective pipe 10 which is adapted in a hole being drilled during drilling and which the drill bit 1 is adapted to pull with it during drilling. Figure 2 is a schematic top view of the drill bit 1 of Figure 1, open at the reamer blade wings 21 of the drill bit 1. Figures 1 and 2 show the drill bit 1 in an unused position or alternatively in such a usage situation where the drill bit 1 is rotated in the opposite direction in relation to the intended drilling direction R in which the drill bit 1 is intended to be rotated during drilling. Figure 3, in turn, shows in a schematic manner a side view of the drill bit 1 of Figure 1, partly in cross-section, during use of the drill bit 1 as the drill bit 1 is rotated in the drilling direction indicated by the arrow R, and Figure 4 is a schematic top view of the drill bit 1 of Figure 1, open at the reamer blade wings 21 of the drill bit 1, in a drill bit 1 usage situation of Figure 3.

[0012] The drill bit 1 comprises a body 2 of the drill bit 1 and a stem 3 of the drill bit 1, which is of one uniform structure with the body 2 of the drill bit, that is, joining seamlessly to the body 2 of the drill bit 1, by means of which stem 3 the drill bit 1 may be connected to a drill rod of a drilling device. Alternatively, the body 2 and stem 3 of the drill bit 1 may be separate parts and joined together by a screw joint, for example. For reasons of clarity, the figures do not show said drilling device or drill rod. The drilling device may comprise a rotating device, only, to rotate the drill rod, whereby the drill rod is adapted to transmit only the rotational movement of the rotating device to the drill bit 1 for the purpose of rotating the drill bit 1 around its centre axis C. The drilling device may also comprise a percussion device to direct a percussive motion to the drill rod, whereby the drill rod is adapted to transmit both the rotational movement of the rotating de-

vice to the drill bit 1 for the purpose of rotating the drill bit 1 and the percussive motion of the percussive device to drive the drill bit 1 against the ground or rock being drilled. Therefore, the drill bit 1 may be intended either for drilling that only comprises rotating the drill bit 1, or drilling comprising both the rotating and percussion of the drill bit 1.

[0013] The body 2 of the drill bit 1 comprises a face 4 directed toward a hole to be drilled, and a rear surface 5 directed away from the hole to be drilled, to which rear surface 5 the stem part 3 of the drill bit 1 is connected, and which rear surface 5 is, as a surface around the stem 3, a circular surface. Between the face 4 and rear surface 5 there is a side 6 of the body 2 of the drill bit 1, which determines the outer circle and outer diameter of the drill bit 1. The side 6 comprises, in the direction of the centre axis C of the drill bit 1, a front part 6a located on the side of the face 4 and ending at it, and a rear part 6b located on the side of the rear surface 5 and ending at it. The outer diameter of the rear part 6b has been dimensioned larger than the outer diameter of the front part 6a, whereby a flange 7 is formed on the side 6 at the rear part 6b and protruding outwards from the side 6, at which the dimension of the outer diameter of the body 2 of the drill bit 1 and the circumference of the outer circle of the brill bit 1 are at their maximum.

[0014] As a result of the mutual dimensioning of the diameters of said front part 6a and rear part 6b, there are surfaces 7a formed at the junction of the front part 6a and rear part 6b, directed towards the hole being drilled. The surfaces 7a form support surfaces 7a to which the protective pipe 10 that the drill bit 1 pulls with it during drilling is supported. Through said support surfaces 7a, a force is transmitted from the drill bit 1 to a shoulder 12 on the inner circle of a mouth 11 of the protective pipe 10, by which the drill bit 1 pulls the protective pipe 10 with it to the hole being drilled as drilling is proceeding. A protective pipe 10 may be used when ramming pipe piles, for example. A protective pipe 10 may also be used, for example, to support the walls of a hole drilled in a soft ground so that the hole walls do not collapse inside the hole being drilled. A protective pipe 10 may also be used as an installation channel, for example, for wires, pipes, cables etc. to be placed underground.

[0015] The body 2 of the drill bit 1 further comprises a cylinder-formed recess 8 directed from the face 4 towards the rear surface 5, the centre axis of which is substantially equal to the centre axis C of the drill bit 1. As a result of said recess 8, the face 4 of the body 2 of the drill bit 1 is circular. On the inner circle of the recess 8, there is an internal thread 9. The purpose of the recess 8 is to receive a part of a pilot bit 13 intended for drilling the centre of the hole being drilled, to be described in more detail below, and to fasten the pilot bit 13 to the body 2 of the drill bit 1 by the inner thread 9 on the circle of the recess 8.

[0016] The drill bit 1 further includes a set of bits to break the ground or rock being drilled. The set of bits of the drill bit 1 comprises a pilot bit 13 meant for drilling the centre of the hole to be drilled, the diameter of which is notably smaller than the outer diameter of the drill bit 1. The pilot bit 13 comprises a bit part 14 directed towards the hole to be drilled, and a stem part 15 directed away from the hole to be drilled, which in the embodiment shown in the figures are of one uniform structure, so seamlessly join each other. Alternatively, the bit part 14 and stem part 15 may be separate parts and joined together by a screw joint, for example. The stem part 15 has an external thread 16 which corresponds to the inner thread 9 on the recess 8 of the body 2 of the drill bit 1, referred to in the above, whereby the pilot bit 13 may be fastened to the body 2 of the drill bit 1 by inserting the stem part 15 of the pilot bit 13 in said recess 8 and turning the pilot bit 13 so that the external thread 16 on the stem part 15 of the pilot bit 13 turns into contact with the inner thread 9 on the recess 8 of the body 2 of the drill bit 1.

[0017] The bit part 14 of the pilot bit 13 comprises a face 14a of the bit part 14, directed towards a hole to be drilled, and a rear surface 14b of the bit part 14, directed away from the hole to be drilled, which, as a surface positioned around the stem part 15, is a circular surface. The face 14a comprises bit pins breaking the surface to the drilled and/or bit edges cutting the surface to be drilled. For reasons of clarity, the figures do not show said bit pins and/or bit edges. In the embodiment of the drill bit 1 of the figures, the face 14a of the bit part 14 of the pilot bit 13 forms the face of the drill bit 1, which is adapted to first meet the surface being drilled.

[0018] The set of bits of the drill bit 1 further comprises a ring bit 17 meant for drilling the outer circle of the hole to be drilled. The ring bit 17 has a face 17a directed towards the hole to be drilled, and a rear surface 17b directed away from the hole to be drilled. The face 17a comprises bit pins breaking the surface to the drilled and/or bit edges cutting the surface to be drilled. For reasons of clarity, the figures do not show said bit pins and/or bit edges.

[0019] The ring bit 17 is adapted around the stem part 15 of the pilot bit 13 between the pilot bit 13 and the body 2 of the drill bit 1 so that the face 17a of the ring bit 17 is positioned towards the rear surface 14b of the bit part 14 of the pilot bit 13 and substantially against it whereby the rear surface 14b of the bit part 14 of the pilot bit 13 to some extent covers the face 17a of the ring bit 17 on its inner circle. The rear surface 17b of the ring bit 17, in turn, sets towards the face 4 of the body 2 of the drill bit 1 and substantially against it. The outer diameter of the ring bit 17 is dimensioned substantially as large as the outer diameter of the face 4 of the body 2 of the ring bit 1, whereby the rear surface 17b of the ring bit 17 substantially in its entirety covers the face 4 of the body 2 of the ring bit 1. However, the body 2, pilot bit 13, and ring bit 17 of the drill bit 1 have been arranged to be adapted in relation to each other with such clearances between the pilot bit 13 and ring bit 17, as well as the ring bit 17 and the body 2 of the drill bit 1, that the ring bit 17 may substantially without obstruction turn, in relation to the

body 2 and the pilot bit 13 of the drill bit 1, around the rotation axis formed by the stem part 15 of the pilot bit 13.

[0020] The drill bit 1 further comprises along the centre axis C of the drill bit 1 a flushing medium channel 18 running through the stem 3, body 2, and pilot bit 13 of the drill bit 1. Through the flushing medium channel 18, flushing medium, such as air or water, is supplied to the drill bit from the drilling device, the purpose of which is to carry drilling waste away from the hole being drilled. The flushing medium channel 18 may extend all the way to the face 14a of the bit part 14 of the pilot bit 13, whereby the face 14a of the bit part 14 of the pilot bit 13 may comprise flushing grooves, not shown in the figures for reasons of clarity, for removing drilling waste from the front of the pilot bit 13 towards the outer circle of the drill bit 1. Part of the flushing medium may be fed to the face 17a of the ring bit 17, whereby the face 17a of the ring bit 17 may comprise flushing grooves, not shown in the figures for reasons of clarity, for removing drilling waste from the front of the ring bit 17 towards the outer circle of the drill bit 1.

[0021] In the side 6 of the body 2 of the drill bit 1, flushing grooves 19 have in turn been formed, through which the drilling waste coming off the hole being drilled is able to pass behind the drill bit 1, from where the drilling waste may further travel along a channel formed between the protective pipe 10 and the stem 3 of the drill bit 1 and the drilling device drill rod, as its extension, out of the hole being drilled.

[0022] The body 2 of the drill bit 1 further comprises, on its face 4, recesses 20 open upward in the direction of the ring bit 17. The recesses 20 proceed or extend in a curved manner, that is, they have an imaginary centre line from the inner circle of the body 2 of the drill bit 1 all the way to the outer circle of the body 2 of the drill bit 1 in a region defined by the front part 6a of the side 6 of the body 2 of the drill bit 1. The curving direction of the recesses 20 from the inner circle of the body 2 of the drill bit 1 to the outer circle of the body 2 of the drill bit 1 is in the opposite direction in relation to the intended rotation direction R of the drill bit 1. So, the recess 20 has a first end 20' located on the inner circle of the body 2 of the drill bit 1, and a second end 20" located on the outer circle of the body 2 of the drill bit 1. The recesses 20 are thus in the front part 6a of the side 6 of the body 2 of the drill bit 1, and open to the outer circle of the body 2 of the drill bit 1. Each recess 20 is located in portions of the body 2 of the drill bit 1 between flushing grooves 19 formed in the side 6 of the body 2 of the drill bit 1 in the direction of the circle of the drill bit 1. The ring bit 17, whose rear surface 17b is placed towards the face 4 of the body 2 of the drill bit 1 as the drill bit 1 is being assembled, bounds the recesses 20 or closes the recesses 20 from above.

[0023] In each recess 20, a reamer blade wing 21 has further been installed, whereby each recess 20 forms a reamer blade wing space 20 for the reamer blade wing 21. Each reamer blade wing 21 is arranged movably in a corresponding reamer blade wing space 20 so that the reamer blade wing 21 is able to partly move out from the reamer blade wing space 20, extending in part out of the reamer blade wing space 20 all the way beyond the largest outer diameter of the drill bit 1, that is, outside the rear part 6b of the side 6 of the body 2 of the drill bit 1, so outside the flange part 7, as will be disclosed in closer detail below, when the rotation of the drill bit 1 is started in the intended drilling direction R. Correspondingly, when the rotation of the drill bit 1 is started in the opposite direction in relation to the intended drilling direction R, the reamer blade wings 21 are arranged to move back inside the reamer blade wing spaces 20. The reamer blade wing 21 has a first end 21' directed towards the inner circle of the body 2 of the drill bit 1, and a second end 21" directed towards the outer circle of the body 2 of the drill bit 1. The reamer blade wing 21 is curved, corresponding to the curvature and direction of curvature of the recesses 20.

[0024] When the drill bit 1 is rotated in the intended drilling direction R, the purpose of the reamer blade wings 21 is to break or enlarge the hole being drilled on its outer circle so that the protective pipe 10 that the drill bit 1 is pulling with it fits in the hole being drilled. Due to this, the reamer blade wings 21 at their outmost position need to extend beyond the largest outer diameter of the drill bit 1 and at the same time beyond the outer diameter of the protective pipe 10. On the other hand, when the drill bit is rotated in the opposite direction in relation to the intended drilling direction R, the reamer blade wings 21 are arranged to return to the reamer blade wing spaces 20. In such a case, there is room for the drill bit 1 to be pulled out in its entirety back from the hole being drilled and no part of the drill bit 1 has to be left on purpose in the drilled hole. This reduces both the costs related to drilling a hole and the time it takes to drill a hole, because a drill bit pulled out of a drilled hole is also immediately ready to use for drilling the subsequent hole.

[0025] The moving of the reamer blade wings 21 out of the reamer blade wing spaces 20 and back into the reamer blade wing spaces 20 is controlled by the ring bit 17. As briefly noted in the above, the ring bit 17 is adapted around the stem part 15 of the pilot bit 13 between the bit part 14 of the pilot bit 13 and the body 2 of the drill bit 1 so that there are clearances between the rear surface 14b of the bit part 14 of the pilot bit 13 and the face 17a of the ring bit 17 as well as the face 4 of the body 2 of the drill bit 1 and the rear surface 17b of the ring bit 17, which allow the ring bit 17 to rotate in relation to the stem part 15 of the pilot bit 13. Said rotation of the ring bit 17 in relation to the stem part 15 of the pilot bit 13 is, in turn, adapted to guide the moving of the reamer blade wings 21 out of the reamer blade wing spaces 20 and back into the reamer blade wing spaces 20 by guide elements arranged on and matched together on the rear surface 17b of the ring bit 17 and reamer blade wings 21.

[0026] For said purpose, the rear surface 17b of the ring bit 17 comprises, as said guide elements on the ring bit 17, curved guide grooves 22 adapted to proceed or

run in a curved manner from the direction of the inner circle of the ring bit 17 to the direction of the outer circle of the ring bit 17, the direction or curvature 1 being to the intended rotation direction R of the drill bit 1. So, the guide groove 22 has a first end 22' in the vicinity of the inner circle of the ring bit 17 at a distance from the inner circle of the ring bit 17 towards the outer circle, and a second end 22" in the vicinity of the outer circle of the ring bit 17 at a distance from the outer circle of the ring bit 17 towards the inner circle. The surface of the reamer blade wings 21, which is upwards so towards the rear surface 17b of the ring bit 17, in turn comprises a curved guide protrusion 23 which is compatible with the curved guide groove 22, the curved guide protrusions 23 forming said guide elements on the reamer blade wings 21.

[0027] The curved guide groove 22 and the curved guide protrusion 23 of the reamer blade wing 21 adapted on it are adapted to guide the movement of the reamer blade wing 21 outwards from the reamer blade wing space 20 and back into the reamer blade wing space 20 along a curved path defined by the reamer blade wing space 20. In an unused position of the drill bit 1, the guide protrusion 23 is positioned at the first end 22' of the guide groove 22, from where it transfers to the second end 22" of the guide groove 22 as the rotation of the drill bit 1 starts in the intended drilling direction. At the outmost end, so the second end 22", of the curved guide groove 22 there is further a locking element, in the embodiment of the figures a locking recess 24 formed in the curved guide groove 22 and directed in the intended rotation direction R of the drill bit 1, the length of which corresponds at least to the length of the guide protrusion 23. As the guide protrusion 23 takes position in said locking recess 24, the ring bit 17 and each reamer blade wing 21 are adapted to lock into each other at such a position where each reamer blade wing 21 is arranged to extend to its outmost position outside the largest outer diameter of the drill bit 1 and outside the outer diameter of the protective pipe 10 possibly included in the drilling activity, at which position the curved guide protrusion 23 on the reamer blade wing 21 is placed in the locking recess 24 in the curved guide groove 22.

[0028] When the drilling of a hole to be drilled is about to begin, the rotation of the drill bit 1 starts in the drilling direction R, whereby the body 2 of the drill bit 1 and the pilot bit 13 fastened thereto start rotating in the drilling direction R. The ring bit 17, in turn, as a result of the associated moment of inertia of the mass and the aforementioned clearances between the body 2 and ring bit 17 of the drill bit 1 and the pilot bit 13 and ring bit 17 at first rotates in the opposite direction in relation to the drilling direction R compared with the body 2 and pilot bit 13 of the drill bit 1. As the ring bit 17 rotates in the opposite direction in relation to the drilling direction R compared to the body 2 and pilot bit 13 of the drill bit 1, the ring bit 17 starts, by the mutual interaction of the curved guide groove 22 on its rear surface and the curved guide protrusion 23 on the reamer blade wing 21 placed in the guide groove 22, to push the reamer blade wings 21 outwards from the reamer blade wing spaces 20. The ring bit 17 pushes the reamer blade wings 21 outwards from the reamer blade wing spaces 20 for as long as the curved guide protrusion 23 in the reamer blade wing 21 is at the outmost end of the curved guide groove 22 in the rear surface 17b of the ring bit 17, that is, the second end 22", whereby the guide protrusion 23 ends up in the locking recess 24 at the second end 22" of the guide groove 22. In this position, which is schematically shown in Figures 3 and 4, the reamer blade wings 21 are at their outmost position, that is, the second end 21" of the reamer blade wings 21 extends past the largest outer diameter of the drill bit 1, the ring bit 17 and reamer blade wings 21 are locked immovably in place in relation to each other, that is, the ring bit 17 and the reamer blade wings 21 do not move in relation to each other. For the sake of clarity, Figure 4 does not show the reamer blade wings 20. The interlocking of the ring bit 17 and reamer blade wings 21 in practise also results in the immovable locking of the ring bit 17 and reamer blade wings 21 also in relation to the body 2 and pilot bit 13 of the drill bit 1. In such a case the ring bit 17 and reamer blade wings 21 also start to rotate together with the body 2 and pilot bit 13 of the drill bit 1 to the intended drilling direction R. In this position, the reamer blade wings 21 break or enlarge the edges of the hole being drilled outside the dimension that the ring bit 17 of the drill bit 1 has drilled so that the protective pipe 10 that the drill bit 1 pulls with it fits to run in the hole being drilled.

[0029] Alternatively, as drilling is about to be started, the reamer blade wings 21 may also be turned outwards in advance by the ring bit 17, whereby the protective pipe 10 may support itself against the reamer blade wings 21 before the friction caused by the walls of the hole being drilled forces the protective pipe 10 and the flange 12 at its mouth 11 to be supported to the support surfaces 7a on the side 6 of the drill bit 1, as referred to in the above.

[0030] According to an embodiment, during the start of drilling, the ring bit 17 may freely rotate in the opposite direction in relation to the drilling direction R by approximately 70 degrees, for example, before the ring bit 17 and reamer blade wings 21 are locked in place. In practise, this means that the ring bit 17 and reamer blade wings 21 are locked in place almost immediately as drilling starts, in practise often even before the drill bit 1 touches the surface to be drilled.

[0031] After the drilling of the hole ends, the intention is to pull the drill bit 1 out of the drilled hole. To this end, after the drilling of the hole ends, rotation of the drill bit 1 is started in the opposite direction in relation to the drilling direction R, whereby the body 2 of the drill bit 1, and the pilot bit 13 fixed thereto, start to rotate in the opposite direction in relation to the drilling direction R. The ring bit 17, in turn, as a result of the associated moment of inertia of the mass and the aforementioned clearances between the body 2 and ring bit 17 of the drill bit 1, and the pilot bit 13 and ring bit 17, at first rotates to

the drilling direction R, so the opposite direction in relation to the body 2 of the drill bit 1 and the pilot bit 13 fastened to it. As the ring bit 17 rotates to the drilling direction R, the curved guide protrusion 23 on the reamer blade wing 21 detaches from the locking recess 24 in the guide groove 22 on the rear surface 17b of the ring bit 17, and the ring bit 17 starts, by the mutual interaction of the curved guide groove 22 on its rear surface 17b and the guide protrusion 23 on the reamer blade wing 21 placed in the guide groove 22, to push the reamer blade wings 21 back inwards into the reamer blade wing spaces 20. The ring bit 17 pushes the reamer blade wings 21 inwards into the reamer blade wing spaces 20 for as long as the curved guide protrusion 23 on the reamer blade wing 21 is at the inmost end of the curved guide groove 22 in the rear surface of the ring bit 17, that is, the first end 22'. In this position, which is schematically shown in Figures 1 and 2, the reamer blade wings 21 are at their inmost position substantially in their entirety inside the reamer blade wing spaces 20, and the ring bit 17 and reamer blade wings 21 are again locked immovably in place in relation to each other, that is, the ring bit 17 and the reamer blade wings 21 no longer move in relation to each other. At the same time, the ring bit 17 and reamer blade wings 21 are in practise also locked immovably in place also in relation to the body 2 and pilot bit 13 of the drill bit 1, whereby the ring bit 17 and reamer blade wings 21 also start to rotate with the body 2 and pilot bit 13 of the drill bit 1 into the opposite direction in relation to the intended drilling direction R. Because the reamer blade wings 21 are now substantially in their entirety inside the reamer blade wing spaces 20, the drill bit 1 may be pulled out in its entirety from the drilled hole, because the drill bit 1 has room to pass through in its entirety the space restricted by the flange 12 at the mouth 11 of the protective pipe 10.

[0032] The reamer blade wings 21 may be manufactured of a plurality of different materials. The reamer blade wings 21 may be manufactured of the same material as the pilot bit and ring bit. The reamer blade wings 21 may also be manufactured of a different material than the pilot bit and ring bit, whereby the service life of the reamer blade wings may differ from that of the pilot bit and ring bit. The reamer blade wings 21 may also be substantially single-use ones, whereby the reamer blade wings 21 may be replaced with new ones after drilling one or a few holes. The replacement of the reamer blade wings 21 takes place easily by removing the pilot bit 13 and ring bit 17, making access possible to the reamer blade wing spaces 20 and the reamer blade wings 21 therein. The reamer blade wings 21 may also be reusable, whereby the portion of the reamer blade wings 21, machining the outer circle of the hole being drilled may resharpened.

[0033] A person skilled in the art will find it obvious that, as technology advances, the basic idea of the invention may be implemented in many different ways. The invention and its embodiments are thus not restricted to the above-described examples but may vary within the scope of the claims. The drill bit 1 according to the embodiment described in the above is specifically intended for drilling a hole where a protective pipe 10 is meant to be installed. The drill bit 1 of the type described may also be used for enlarging a hole already drilled, for example, whereby it is not necessary at all for the drill bit 1 to have the support surfaces 7a for pulling the protective pipe 10 into the hole being drilled.

Claims

1. A drill bit (1) comprising:

   a body (2) of the drill bit (1),
   a pilot bit (13) for drilling a centre part of a hole to be drilled,
   a ring bit (17) for drilling an outer circle of the hole being drilled, and reamer blade wings (21) moving outward from a side (6) of the body (2) of the drill bit (1), which are arranged, when the drill bit (1) is rotated in the intended drilling direction, to move outwards from the side (6) of the body (2) of the drill bit (1), extending past the largest outer diameter of the body (2) of the drill bit (1) to enlarge the hole being drilled, and as the drill bit (1) is rotated in the opposite direction, to return back inside the largest outer diameter of the body (2) of the drill bit (1) for pulling out the drill bit (1) from the hole being drilled, **characterised in that** the ring bit (17) is adapted to guide the moving of the reamer blade wings (21).

2. A drill bit as claimed in claim 1, **characterised in that** the body (2) of the drill bit (1) comprises a face (4) directed towards the hole to be drilled, and a rear surface (5) directed away from the hole to be drilled as well as, extending between them, a side (6) of the drill bit (1), comprising in the direction of the centre axis (C) of the drill bit (1) a front part (6a) located on the side of the face (4), and a rear part (6b) located on the side of the rear surface (5), the outer diameter of which is dimensioned larger than the outer diameter of the front part (6a), whereby at the joint of the front part (6a) and rear part (6b) a face (7a) forms, directed towards the hole to be drilled, which establishes a support surface for a protective pipe (10) pulled into the hole being drilled with the drill bit (1).

3. A drill bit (1) as claimed in claim 1, **characterised in that** the body (2) of the drill bit (1) comprises a face (4) directed towards the hole to be drilled, and a rear surface (5) directed away from the hole to be drilled, and a stem (3) of the drill bit (1), arranged in connection with the rear surface (5), by means of which the drill bit (1) is fastenable in connection with a drilling

device, and **in that** the pilot bit (13) comprises a bit part (14) which has a face (14a) directed towards the hole to be drilled, and a rear surface (14b) directed towards the body (2) of the drill bit (1) and in connection with it a stem part (15) by which the pilot bit (13) is detachably fastenable to the body of the drill bit (1), and **in that** the ring bit (17) is arranged around the stem part (15) of the pilot bit (13), between the rear surface (14b) of the bit part (14) of the pilot bit (13) and the face (4) of the body (2) of the drill bit (1), and comprises a face (17a) directed towards the hole to be drilled and a rear surface (17b) directed towards the face (4) of the body (2) of the drill bit (1).

4. A drill bit as claimed in claim 3, **characterised in that** the body (2) of the drill bit (1) comprises a recess (8) directed from the face (4) of the body (2) towards the rear surface (5) and comprising an inner thread (9) to receive the stem part (15) of the pilot bit (13), and **in that** the pilot bit (13) comprises an external thread (16) compatible with said inner thread, whereby the pilot bit (13) is adapted to be fastened to the body (2) of the drill bit (1) by said threads (9, 16).

5. A drill bit as claimed in any one of the preceding claims, **characterised in that** the drill bit (1) comprises reamer blade wing spaces (20) open outwards from the side (6) of the body (2) of the drill bit (1) and a reamer blade wing (21) placed in each reamer blade wing space (20) and arranged movably in relation to it, whereby when the drill bit (1) is rotated in the intended drilling direction, the reamer blade wing (21) is arranged to move at least partly out of the reamer blade wing space (20) through a second end (20") of the reamer blade wing space (20), open on the side of the body (2) of the drill bit (1), outside the largest outer diameter of the drill bit (1) to enlarge the hole being drilled and when the drill bit (1) is rotated in the opposite direction, to return substantially in its entirety to the reamer blade wing space (20).

6. A drill bit as claimed in claims 3 and 5, **characterised in that** the reamer blade wing spaces (20) are arranged on the face (4) of the body (2) of the drill bit (1), whereby the rear surface (17b) of the ring bit (17) is arranged to bound the reamer blade wing space (20) in the direction indicated by the face (4) of the body (2) of the drill bit (1).

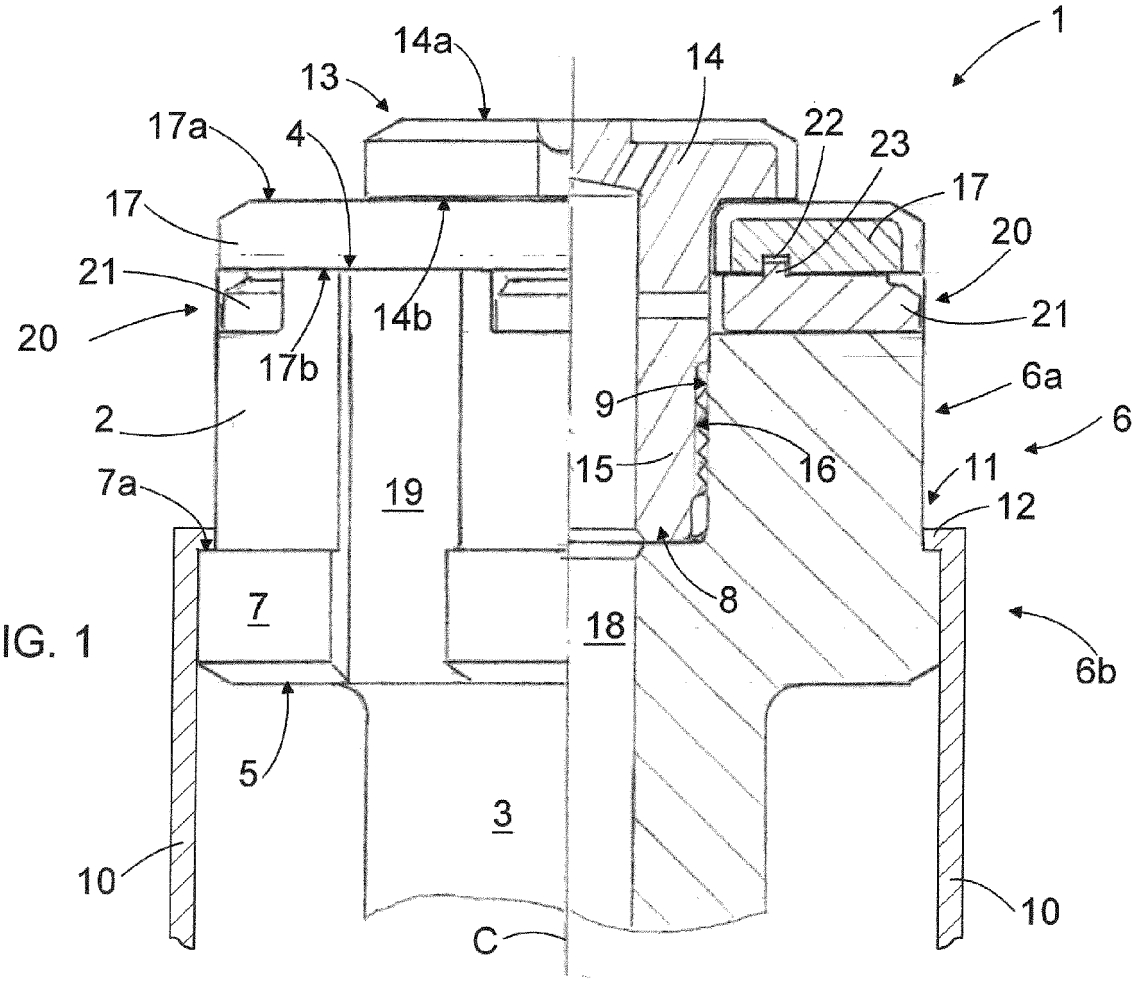
7. A drill bit as claimed in any one of the preceding claims, **characterised in that** the ring bit (17) is adapted to guide the moving of the reamer blade wings (21) out of the reamer blade wing spaces (20) and back into the reamer blade wing spaces (20).

8. A drill bit as claimed in any one of claims 3 to 7, **characterised in that** the ring bit (17) is adapted around the stem part (15) of the pilot bit (13) between the bit part (14) of the pilot bit (13) and the body (2) of the drill bit (1) so that there are clearances between the rear surface (14b) of the bit part (14) of the pilot bit (13) and the face (17a) of the ring bit (17) as well as the face (4) of the body (2) of the drill bit (1) and the rear surface (17b) of the ring bit (17), which allow the ring bit (17) to rotate in relation to the stem part (15) of the pilot bit (13), and **in that** the rear surface (17b) of the ring bit (17) comprises a guide element guiding the moving of each reamer blade wing (21), and each reamer blade wing (21) comprises a counter element in connection with a corresponding guide element to arrange the reamer blade wing (21) in connection with the ring bit (17), whereby said rotation of the ring bit (17) in relation to the stem part (15) of the pilot bit (13) is adapted to guide the moving out of the reamer blade wings (21) from the reamer blade wing spaces (20) and back into the reamer blade wing spaces (20).

9. A drill bit as claimed in claim 8, **characterised in that** said guide element of the ring bit (17) is a curved groove (22) formed in the rear surface (17b) of the ring bit (17) and running from the direction of the inner circle to the direction of the outer circle of the ring bit (17), and **in that** said counter element of the reamer blade wing (21) is a curved guide protrusion (23) formed in the surface of the reamer blade wing (21), directed towards the ring bit (17), which is adaptable in the curved groove (22) formed in the rear surface (17b) of the ring bit (17).

10. A drill bit as claimed in claim 9, **characterised in that** the curved groove (22) formed in the rear surface (17b) of the ring bit (17) comprises a locking groove (24), formed at the end of the curved groove (22) on the side of the outer circle of the ring bit (17), by which the ring bit (17) and each reamer blade wing (21) are adapted to lock into each other at such a position where each reamer blade wing (21) is arranged to extend to its outmost position outside the largest outer diameter of the drill bit (1)

11. A drill bit as claimed in claim 1, **characterised in that** as drilling is started, the ring bit (17) is arranged to rotate, as a result of the associated moment of inertia of the mass, in the opposite direction in relation to the intended drilling direction (R), whereby the ring bit (17) is arranged to push the reamer blade wings (21) outwards from the reamer blade wing spaces (20) by the mutual interaction of the curved guide groove (22) on the rear surface (17b) of the ring bit (17) and the curved guide protrusion (23) on the reamer blade wing (21) placed in the guide groove (22).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17a
4
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23
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17
20
21
21
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14b
17b
21
6a
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7a
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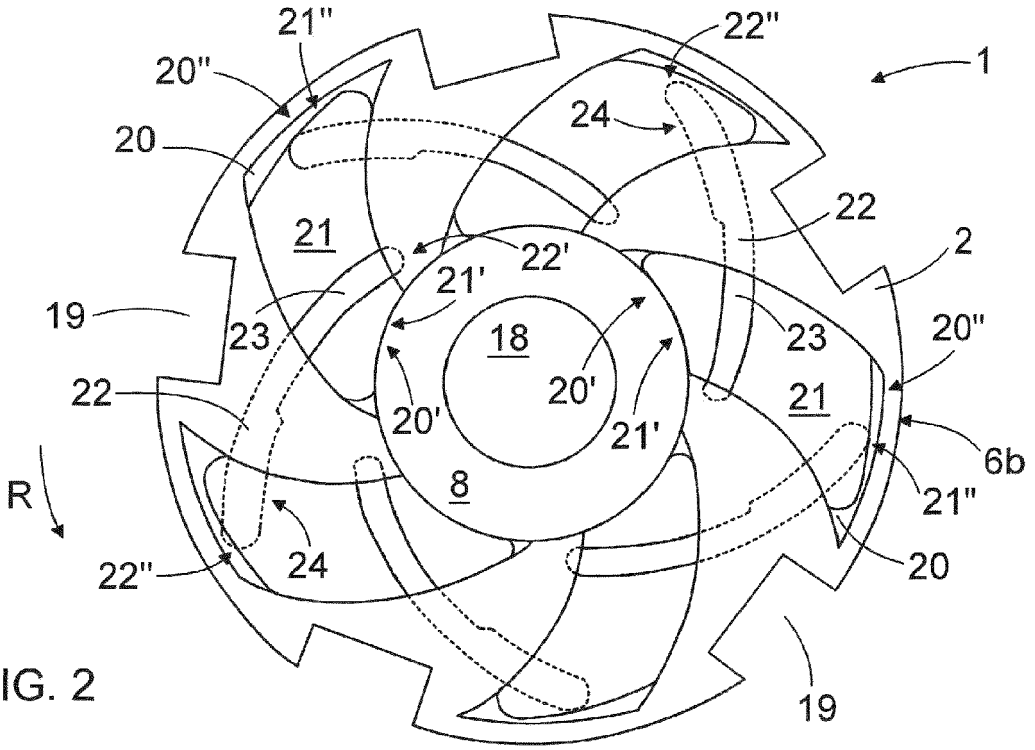
7
18
8
6b
5
3
10
10
C

FIG. 1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20"
1
24
20
22
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2
22'
21'
19
23
18
23
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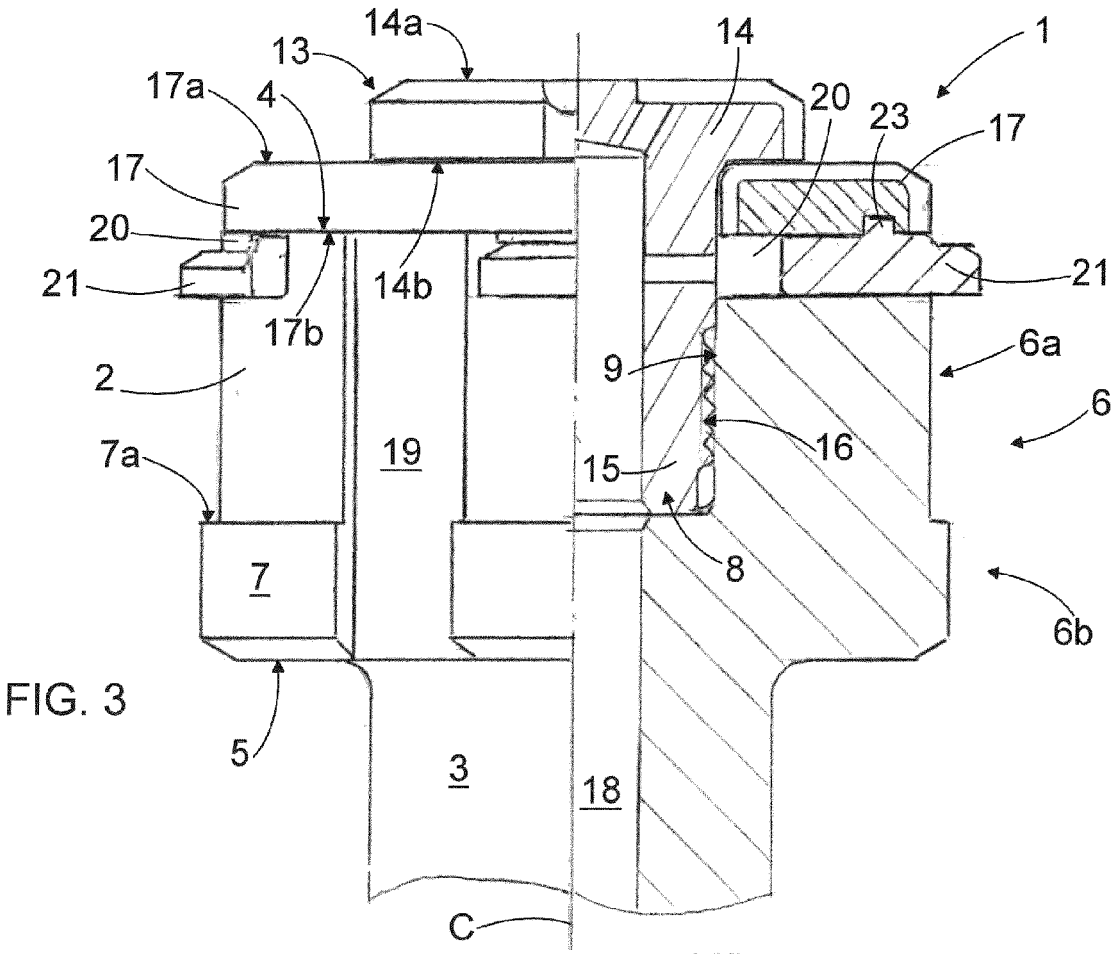
20'
20'
21
21'
6b
R
8
21"
22"
24
20
19

FIG. 2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4
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17b
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20
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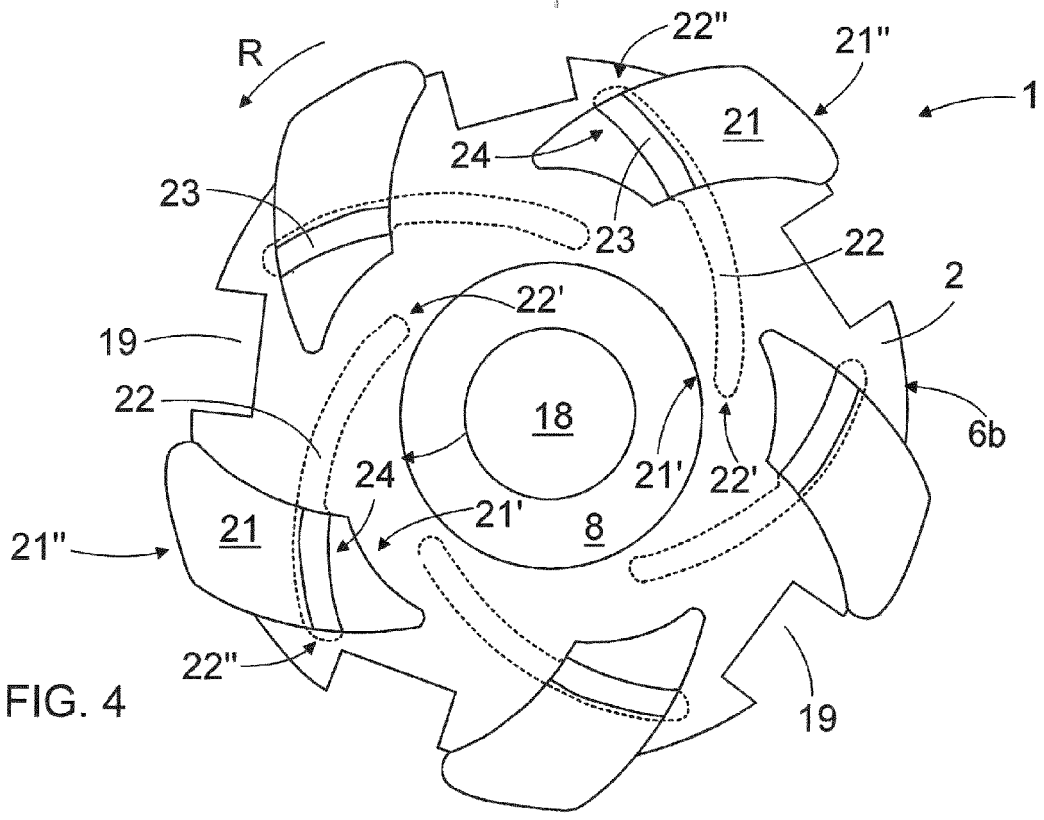
8
6b
5
3
18
C

FIG. 3


R
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21"
1
21
24
23
23
22
2
22'
19
22
18
6b
24
21'
22'
21'
21
8
21"
22"
19

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 18 21 4476

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 May 2019	Simunec, Duro

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